FEDERAL AVIATION REGULATIONS

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION-WASHINGTON, DC

CHANGE 10 **EFFECTIVE: MARCH** 12, 1997

Part 25—Airworthiness Standards: Transport Category Airplanes

This change incorporates Amendment 25–90, Operating Requirements: Domestic, Flag, Supplemental, Commuter, and On-Demand Operations: Corrections and Editorial Changes, adopted and effective March 12, 1997. Section 25.1303(b)(4) is amended by this final rule.

Bold brackets enclose the most recently changed and added material. The amendment number and effective date of the new material appear in bold brackets at the end of each affected section.

Page Control Chart

Remove Pages	Dated	Insert Pages	Dated
		P–613 through P–620	Ch. 10
Subpart F	Ch. 8	Subpart F	Ch. 10

Suggest filing this transmittal at the beginning of the FAR. It will provide a method for determining that all changes have been received as listed in the current edition of AC 00–44, Status of Federal Aviation Regulations, and a check for determining if the FAR contains the proper pages.

have been identified. In addition, a new Special Federal Aviation Regulation (SFAR) is needed to address three problems that relate to compliance with requirements for communications facilities and for aircraft dispatchers by operators in Alaska and other areas.

Public Comment .

The FAA requested comments, within 30 days of publication of Notice No. 97–1, on a number of proposals contained in the NPRM. Interested persons were invited to participate in this rulemaking action by submitting written data, views, or arguments. All comments received were considered before issuing this final rule.

The FAA received 19 comments in response to Notice No. 97–1. Comments were received from operators affected by the proposed rule, aircraft dispatchers, industry associations, and a manufacturer of communications system. Many commenters stressed the importance of having the final rule issued before March 20, 1997, when the majority of the commuter rule provisions go into effect. Other specific comments are summarized in the following section-by-section discussion of the final rule, which includes the FAA's responses to these comments.

Explanation of Amendments

A number of changes are necessary in parts 21, 25, 91, 119, 121, 125, and 135 to correct typographical errors, to make minor editorial changes that help clarify the intent of the rules, or to make editorial changes that make related rules consistent with each other. These types of changes are not individually explained. However, a number of changes require some explanation, which follows:

1. The proposal revised the definitions of "on-demand operation," "scheduled operation," and "supplemental operation" in § 119.3 to make it clear that public charter operations conducted under 14 CFR part 380 are not considered scheduled operations.

No comments were received on the proposed definitions and the changes to § 119.3 are adopted as proposed.

2. The proposal amended § 119.5 to add new paragraph (k), which incorporated former § 135.31 into part 119. As proposed, this section prohibited advertising or otherwise offering to perform any operation unauthorized by the FAA, and it was applicable to any person, including certificate holders operating under part 121, as well as those operating under part 135.

The proposal also added § 119.5(l) which stated that, for safety purposes, people who operate aircraft under parts 121 and 135 must comply with the provisions in a certificate holder's operations specifications. This paragraph was proposed to prevent an employee of a certificate holder (with or without other certificate holder's knowledge) from violating the provisions of the certificate holder's operations specifications. For example, if a certificate holder is only authorized to carry cargo, a flight crewmember would not be allowed to bring along a friend as a passenger on the commercial flight.

No comments were received on these proposals and the changes to § 119.5 are adopted as proposed.

3. The proposal amended § 119.9 to allow displaying the air carrier or operating certificate number on an aircraft instead of the name of the certificate holder. As described in the NPRM, a petition by the National Air Transportation Association (NATA) and supporting comments requested that, for security and financial reasons, operators be allowed to display the air carrier or operating certificate number in lieu of the name of the certificate holder. In the NPRM, the FAA agreed that display of an air carrier or operating certificate number would meet the intent of this requirement, which is to provide a ready means of identifying a responsible certificate holder when an aircraft is parked and the FAA has reason to identify or contact the certificate holder. Therefore, the FAA proposed to amend § 119.9(b)(4) as requested by NATA.

The proposal also deleted the provision allowing the Assistant Administrator for Civil Aviation Security to grant deviations from the requirements of this section because the FAA no longer believed that these deviations were necessary.

NATA, Helicopter Association International (HAI), and individual operators affected by the proposed change to § 119.9(b) comment in support of allowing part 135 operators to display their air carrier or operating certificate number on an aircraft instead of the name of the certificate holder. Commenters emphasize that, if the FAA adopts the proposed amendment, it is imperative to make the amendment effective before March 20, 1997, so that they will not need to apply the certificate holder's name temporarily on the aircraft, and then remove it when the amendment takes effect later. One operator comments that even having the operating certificate number on the aircraft creates a security risk for some customers.

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Therefore the FAA proposed to allow certificate holders conducting scheduled operations in Alaska with airplanes having a passenger-seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pounds or less under part 121 of this chapter, to share aircraft dispatchers if they are authorized to do so by the Administrator in their operations specifications. The requests will be processed through the certificate-holding district office, with concurrence by the FAA's Air Transportation Division (AFS–200). Before granting such an authorization, the Administrator would consider certain factors that are listed in the SFAR.

The FAA proposed that the SFAR would expire 4 years after it is issued because the FAA expects that adequate communications facilities would become available in all parts of Alaska and other areas within that time.

Several commenters address the provisions in the proposed SFAR. The Air Transport Association (ATA) sees no reason why the SFAR should be so restrictive and limited to commuter operations, because from a safety standpoint, larger aircraft have greater fuel capacity and alternate airport capability, and generally have a larger safety margin built in than small commuter aircraft. NATA believes that the proposed SFAR does not adequately address the special nature of flight operations in rural Alaskan areas, because the inherent problem is that Alaska simply does not have the infrastructure to guarantee communications in remote areas. Also NATA believes that operations in designated remote areas, where flights are mainly VFR, flight plans frequently change, and airports are often unattended, should not be subjected to the same stringent dispatching requirements applied to other part 121 operations. An aeronautical communications company disagrees with FAA's statements on lack of infrastructure and availability of appropriate technology. This commenter believes that there is a wide variety of choices available to meet the communication needs for positive operational control and that operators in remote geographical areas may need to make a combination of choices to allow them to meet the requirements of the current rules.

The Airline Dispatchers Federation (ADF) and an individual aircraft dispatcher address the relationship between the communications system required by § 12 1.99 and the role of the aircraft dispatcher in providing information that may affect the safety of the flight to the pilot in command. ADF believes that adequate air ground communication technology is available for Alaskan operations, but that if there is a lack of weather reporting along their routes, air carriers can provide station and other personnel with telephone, dial access radio, HF, VHF, or SatComm communications and provide them with the training to provide accurate weather and aerodrome information. ADF further suggests that Alaskan air carriers cooperate to build their own radio network to cover their routes or that the State of Alaska may want to help finance any additional infrastructure required for scheduled air service in Alaska.

ADF suggests that Alaskan pilots, operating under a "bush" mentality, have knowingly flown in IMC or VFR flights in response to operational pressures, and that when adequate communication systems are in place and aircraft dispatchers are able to obtain accurate information on weather and other local conditions, the pilots will no longer be able to decide on their own whether or not to initiate or continue a particular flight, because, if the information does not show the operation can be conducted safely, the dispatcher may not authorize the flight.

ADF and the aircraft dispatcher object to FAA's proposal to allow Alaskan air carriers to share aircraft dispatchers under certain conditions. The commenters fear that a dispatcher working under contract or exercising operational control on a competitor's flight may have his or her actions second-guessed by the management of the other airline. ADF comments that a shared dispatcher may be kept at a distance from the operations and only told what company employees want the dispatcher to know.

ADF and the dispatcher believe that part 135 operators who have faced the challenge of complying with the communications and dispatching rules of part 121 should be commended and not effectively penalized economically by competitors who take advantage of the provisions in the proposed SFAR.

After careful consideration of these comments, the FAA has decided to issue the SFAR as proposed. The FAA disagrees with ATA's assertion that the SFAR should also apply to air carriers operating larger planes, but instead agrees with ADF that the rules in part 121 requiring adequate communications systems and a full aircraft dispatching system for scheduled operations have contributed for many years to a high level of safety that should be applied as well to scheduled operations affected by the commuter rule. The purpose of the SFAR is to allow the FAA, the affected commuter operators, and the communications equipment industry to work together to bring every commuter operator into compliance with part 121 as soon as possible. However, the FAA's experience in implementing the commuter rule has been that there ***are*** gaps in certain remote areas that could not be remedied before the March 20, 1997, deadline for implementing -the commuter rule. This is the exception rather than the rule. The limited number of commuter operators who have not been able to close the communications gaps along all of their routes have been evaluating systems and trying to develop plans for complying with § 121.99.

The SFAR will allow extra time for the installation of ground-based systems, the development of satellite systems, or the development and approval of technology appropriate to the needs of remote operators.

The FAA agrees with commenters that the role of aircraft dispatchers is critical to ensuring the safety of flight, particularly in areas such as Alaska that are subject to difficult and changing weather conditions. That is why the FAA is not excepting Alaskan carriers from the dispatcher requirement. However,' under section 1205 of the Federal Aviation Reauthorization Act of 1996 (Pub. L. 104–264), when modifying regulations affecting intrastate aviation in Alaska, the FAA Administrator must consider the extent to which Alaska is not served by transportation modes other than aviation, and must establish such regulatory distinctions as the Administrator considers appropriate. Also, in implementing the commuter rule, the FAA has found that in the unique environment of Alaska, it is difficult to recruit and retain qualified certificated aircraft dispatchers. The commenters' fears about the potential for contract dispatchers or dispatchers exercising operational control over competitors' flights are unwarranted because the SFAR allows for the sharing of dispatchers by 2 companies, not for the contracting out of dispatching services. The 2 companies would be authorized to share a dispatcher only when the companies can show to the FAA that they have joint plans for complying with the dispatcher training and qualification rules and that the number of flights for which the dispatcher would be responsible would not be beyond the capacity of a single dispatcher.

The FAA does not think that authority to operate under the SFAR would provide an economic advantage to a commuter operator because the authority will be granted in a very limited number of cases and only when the operator has shown to the FAA that it is proceeding on a plan and has a schedule for coming into full compliance with the part 12 1 rules within 4 years.

8. The proposal amended § 121.99 to allow for "other means of communication approved by the Administrator' ' as an alternative to the two-way radio communication system required by that section. This would allow certificate holders to use other types of technology, such as datalink or telephonic communication systems, to comply with this section.

No comments were received on the proposal and the changes to § 121.99 are adopted as proposed.

9. The proposal amended the manual requirements in §§ 121.137, 121.139, 125.71, 135.21, and 135.427 to make these sections compatible with § 12 1.133. (Section 12 1.133 had been revised in the commuter rule to allow a certificate holder to prepare its maintenance manual in any form acceptable to the Administrator.) Therefore, the FAA proposed in the NPRM to include the language "any form acceptable to the Administrator" in the sections above.

The proposal also amended these sections to clarify that, regardless of the form of the maintenance manual, it must be retrievable in the English language. Certificate holders who purchase equipment from foreign manufacturers or previous foreign owners must ensure that the maintenance instructions to be followed by their employees and reviewed by the FAA are in English.

No comments were received on the proposal and the changes to the manual requirements are adopted as proposed.

10. The proposal revised § 121.305(j) to clarify the requirements for third attitude indicators for turbopropeller-powered airplanes having a passenger seat configuration of 30 seats or fewer and turbo-propeller-powered airplanes with more than 30 seats. The latter have been required to have third attitude indicators since October 1994.

No comments were received on the proposal and the changes to § 121.305 are adopted as proposed.

11. The FAA proposed to allow 2 years from the date of the final rule for the affected operators to install emergency exit locating signs that comply with § 121.3 10(b)(1). The additional 2 years for compliance would be granted to both in-service 10–19 seat airplanes and newly manufactured 10–19 seat airplanes. Paragraph (b)(1) of § 121.3 10 requires that the identity and location of each passenger emergency exit must be marked so that the exit is recognizable from a 'distance equal to the width of the cabin and that the location of the exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. Paragraph (b)(l)(i) requires that one of the locating signs must be on the ceiling of the cabin. Because of limited headroom, most of the 10–19 seat airplanes used by operators subject to the commuter rule do not have locating signs on the ceiling, but have been allowed to use two-dimensional signs mounted flush to the cabin sidewalls. For these 10–19 seat airplanes with limited headroom, the simplest means of complying may be to replace the two-dimensional signs with beveled or three-dimensional signs that can be read easily at the cabin extremes; that type of sign would function to both identify and locate the corresponding exit.

The SFAR will allow extra time for the installation of ground-based systems, the development of satellite systems, or the development and approval of technology appropriate to the needs of remote operators.

The FAA agrees with commenters that the role of aircraft dispatchers is critical to ensuring the safety of flight, particularly in areas such as Alaska that are subject to difficult and changing weather conditions. That is why the FAA is not excepting Alaskan carriers from the dispatcher requirement. However,' under section 1205 of the Federal Aviation Reauthorization Act of 1996 (Pub. L. 104–264), when modifying regulations affecting intrastate aviation in Alaska, the FAA Administrator must consider the extent to which Alaska is not served by transportation modes other than aviation, and must establish such regulatory distinctions as the Administrator considers appropriate. Also, in implementing the commuter rule, the FAA has found that in the unique environment of Alaska, it is difficult to recruit and retain qualified certificated aircraft dispatchers. The commenters' fears about the potential for contract dispatchers or dispatchers exercising operational control over competitors' flights are unwarranted because the SFAR allows for the sharing of dispatchers by 2 companies, not for the contracting out of dispatching services. The 2 companies would be authorized to share a dispatcher only when the companies can show to the FAA that they have joint plans for complying with the dispatcher training and qualification rules and that the number of flights for which the dispatcher would be responsible would not be beyond the capacity of a single dispatcher.

The FAA does not think that authority to operate under the SFAR would provide an economic advantage to a commuter operator because the authority will be granted in a very limited number of cases and only when the operator has shown to the FAA that it is proceeding on a plan and has a schedule for coming into full compliance with the part 12 1 rules within 4 years.

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The proposal also amended these sections to clarify that, regardless of the form of the maintenance manual, it must be retrievable in the English language. Certificate holders who purchase equipment from foreign manufacturers or previous foreign owners must ensure that the maintenance instructions to be followed by their employees and reviewed by the FAA are in English.

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The SFAR will allow extra time for the installation of ground-based systems, the development of satellite systems, or the development and approval of technology appropriate to the needs of remote operators.

The FAA agrees with commenters that the role of aircraft dispatchers is critical to ensuring the safety of flight, particularly in areas such as Alaska that are subject to difficult and changing weather conditions. That is why the FAA is not excepting Alaskan carriers from the dispatcher requirement. However,' under section 1205 of the Federal Aviation Reauthorization Act of 1996 (Pub. L. 104–264), when modifying regulations affecting intrastate aviation in Alaska, the FAA Administrator must consider the extent to which Alaska is not served by transportation modes other than aviation, and must establish such regulatory distinctions as the Administrator considers appropriate. Also, in implementing the commuter rule, the FAA has found that in the unique environment of Alaska, it is difficult to recruit and retain qualified certificated aircraft dispatchers. The commenters' fears about the potential for contract dispatchers or dispatchers exercising operational control over competitors' flights are unwarranted because the SFAR allows for the sharing of dispatchers by 2 companies, not for the contracting out of dispatching services. The 2 companies would be authorized to share a dispatcher only when the companies can show to the FAA that they have joint plans for complying with the dispatcher training and qualification rules and that the number of flights for which the dispatcher would be responsible would not be beyond the capacity of a single dispatcher.

The FAA does not think that authority to operate under the SFAR would provide an economic advantage to a commuter operator because the authority will be granted in a very limited number of cases and only when the operator has shown to the FAA that it is proceeding on a plan and has a schedule for coming into full compliance with the part 12 1 rules within 4 years.

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No comments were received on the proposal and the changes to § 121.305 are adopted as proposed.

11. The FAA proposed to allow 2 years from the date of the final rule for the affected operators to install emergency exit locating signs that comply with § 121.3 10(b)(1). The additional 2 years for compliance would be granted to both in-service 10–19 seat airplanes and newly manufactured 10–19 seat airplanes. Paragraph (b)(1) of § 121.3 10 requires that the identity and location of each passenger emergency exit must be marked so that the exit is recognizable from a 'distance equal to the width of the cabin and that the location of the exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. Paragraph (b)(l)(i) requires that one of the locating signs must be on the ceiling of the cabin. Because of limited headroom, most of the 10–19 seat airplanes used by operators subject to the commuter rule do not have locating signs on the ceiling, but have been allowed to use two-dimensional signs mounted flush to the cabin sidewalls. For these 10–19 seat airplanes with limited headroom, the simplest means of complying may be to replace the two-dimensional signs with beveled or three-dimensional signs that can be read easily at the cabin extremes; that type of sign would function to both identify and locate the corresponding exit.

(8) An augmentation liquid quantity indicator (appropriate for the manner in which the liquid is to be used in operation) for each tank.

(b) *For reciprocating engine-powered airplanes.* In addition to the powerplant instruments required by paragraph (a) of this section, the following power-plant instruments are required:

(1) A carburetor air temperature indicator for each engine.

(2) A cylinder head temperature indicator for each air-cooled engine.

(3) A manifold pressure indicator for each engine.

(4) A fuel pressure indicator (to indicate the pressure at which the fuel is supplied) for each engine.

(5) A fuel flowmeter, or fuel mixture indicator, for each engine without an automatic altitude mixture control.

(6) A tachometer for each engine.

(7) A device that indicates, to the flight crew (during flight), any change in the power output, for each engine with-

(i) An automatic propeller feathering system, whose operation is initiated by a power output measuring system; or

(ii) A total engine piston displacement of 2,000 cubic inches or more.

(8) A means to indicate to the pilot when the propeller is in reverse pitch, for each reversing propeller.

(c) *For turbine engine-powered airplanes.* In addition to the power-plant instruments required by paragraph (a) of this section, the following power-plant instruments are required:

(1) A gas temperature indicator for each engine.

(2) A fuel flowmeter indicator for each engine.

(3) A tachometer (to indicate the speed of the rotors with established limiting speeds) for each engine.

(4) A means to indicate, to the flight crew, the operation of each engine starter that can be operated continuously but that is neither designed for continuous operation nor designed to prevent hazard if it failed.

(5) An indicator to indicate the functioning of the power-plant ice protection system for each engine.

(6) An indicator for the fuel strainer or filter required by § 25.997 to indicate the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with § 25.997(d).

(7) A warning means for the oil strainer or filter required by § 25.1019, if it has no bypass, to warn the pilot of the occurrence of contamination of the strainer or filter screen before it reaches the capacity established in accordance with § 25.1019(a)(2).

(8) An indicator to indicate the proper functioning of any heater used to prevent ice clogging of fuel system components.

(d) *For turbojet engine powered airplanes.* In addition to the powerplant instruments required by paragraphs (a) and (c) of this section, the following powerplant instruments are required:

(1) An indicator to indicate thrust, or a parameter that is directly related to thrust, to the pilot. The indication must be based on the direct measurement of thrust or of parameters that are directly related to thrust. The indicator must indicate a change in thrust resulting from' any engine malfunction, damage, or deterioration.

(2) A position indicating means to indicate to the flight crew when the thrust reversing device is in the reverse thrust position, for each engine using a thrust reversing device.

(3) An indicator to indicate rotor system unbalance.

(e) *For turbopropeller-powered airplanes.* In addition to the powerplant instruments required by paragraphs (a) and (c) of this section, the following powerplant instruments are required:

(1) A torque indicator for each engine.

(2) Position indicating means to indicate to the flight crew when the propeller blade angle is below the flight low pitch position, for each propeller.

(f) For airplanes equipped with fluid systems (other than fuel) for thrust or power augmentation, an approved means must be provided to indicate the proper functioning of that system to the flight crew.

(Amdt. 25–11, Eff. 6/4/67); (Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–35, Eff. 3/1/74); (Amdt. 25–36, Eff. 10/31/74); (Amdt. 25–38, Eff. 2/1/77); (Amdt. 25–54, Eff. 10/14/80); (Amdt. 25–72, Eff. 8/20/90)

§25.1307 Miscellaneous equipment.

The following is required miscellaneous equipment:

(a) [Reserved]

(b) Two or more independent sources of electrical energy.

(c) Electrical protective devices, as prescribed in this part.

(8) An augmentation liquid quantity indicator (appropriate for the manner in which the liquid is to be used in operation) for each tank.

(b) *For reciprocating engine-powered airplanes.* In addition to the powerplant instruments required by paragraph (a) of this section, the following power-plant instruments are required:

(1) A carburetor air temperature indicator for each engine.

(2) A cylinder head temperature indicator for each air-cooled engine.

(3) A manifold pressure indicator for each engine.

(4) A fuel pressure indicator (to indicate the pressure at which the fuel is supplied) for each engine.

(5) A fuel flowmeter, or fuel mixture indicator, for each engine without an automatic altitude mixture control.

(6) A tachometer for each engine.

(7) A device that indicates, to the flight crew (during flight), any change in the power output, for each engine with-

(i) An automatic propeller feathering system, whose operation is initiated by a power output measuring system; or

(ii) A total engine piston displacement of 2,000 cubic inches or more.

(8) A means to indicate to the pilot when the propeller is in reverse pitch, for each reversing propeller.

(c) *For turbine engine-powered airplanes.* In addition to the powerplant instruments required by paragraph (a) of this section, the following power-plant instruments are required:

(1) A gas temperature indicator for each engine.

(2) A fuel flowmeter indicator for each engine.

(3) A tachometer (to indicate the speed of the rotors with established limiting speeds) for each engine.

(4) A means to indicate, to the flight crew, the operation of each engine starter that can be operated continuously but that is neither designed for continuous operation nor designed to prevent hazard if it failed.

(5) An indicator to indicate the functioning of the powerplant ice protection system for each engine.

(6) An indicator for the fuel strainer or filter required by § 25.997 to indicate the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with § 25.997(d).

(7) A warning means for the oil strainer or filter required by § 25.1019, if it has no bypass, to warn the pilot of the occurrence of contamination of the strainer or filter screen before it reaches the capacity established in accordance with § 25.1019(a)(2).

(8) An indicator to indicate the proper functioning of any heater used to prevent ice clogging of fuel system components.

(d) *For turbojet engine powered airplanes.* In addition to the powerplant instruments required by paragraphs (a) and (c) of this section, the following powerplant instruments are required:

(1) An indicator to indicate thrust, or a parameter that is directly related to thrust, to the pilot. The indication must be based on the direct measurement of thrust or of parameters that are directly related to thrust. The indicator must indicate a change in thrust resulting from' any engine malfunction, damage, or deterioration.

(2) A position indicating means to indicate to the flight crew when the thrust reversing device is in the reverse thrust position, for each engine using a thrust reversing device.

(3) An indicator to indicate rotor system unbalance.

(e) *For turbopropeller-powered airplanes.* In addition to the powerplant instruments required by paragraphs (a) and (c) of this section, the following powerplant instruments are required:

(1) A torque indicator for each engine.

(2) Position indicating means to indicate to the flight crew when the propeller blade angle is below the flight low pitch position, for each propeller.

(f) For airplanes equipped with fluid systems (other than fuel) for thrust or power augmentation, an approved means must be provided to indicate the proper functioning of that system to the flight crew.

(Amdt. 25–11, Eff. 6/4/67); (Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–35, Eff. 3/1/74); (Amdt. 25–36, Eff. 10/31/74); (Amdt. 25–38, Eff. 2/1/77); (Amdt. 25–54, Eff. 10/14/80); (Amdt. 25–72, Eff. 8/20/90)

§ 25.1307 Miscellaneous equipment.

The following is required miscellaneous equipment:

(a) [Reserved]

(b) Two or more independent sources of electrical energy.

(c) Electrical protective devices, as prescribed in this part.

of the systems to perform these functions are not adversely affected when the airplane is exposed to lightning.

(b) For functions whose failure would contribute to or cause a condition that would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions, each electrical and electronic system that performs these functions must be designed and installed to ensure that these functions can be recovered in a timely manner after the airplane is exposed to lightning.

(c) Compliance with the lightning protection criteria prescribed in paragraphs (a) and (b) of this section must be shown for exposure to a severe lighting environment. The applicant must design for and verify that aircraft electrical/electronic systems are protected against the effects of lightning by:

(1) Determining the lightning strike zones for the airplane;

(2) Establishing the external lightning environment for the zones;

(3) Establishing the internal environment;

(4) Identifying all the electrical and electronic systems that are subject to the requirements of this section, and their locations on or within the airplane;

(5) Establishing the susceptibility of the systems to the internal and external lightning environment;

(6) Designing protection; and

(7) Verifying that the protection is adequate.]

[(Amdt. 25–80, Eff. 5/3 1/94)]

INSTRUMENTS: INSTALLATION

§25.1321 Arrangement and visibility.

(a) Each flight, navigation, and powerplant instrument for use by any pilot must be plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) The flight instruments required by § 25.1303 must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of the pilot's forward vision. In addition—

(1) The instrument that most effectively indicates attitude must be on the panel in the top center position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top center position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top center position; and

(4) The instrument that most effectively indicates direction of flight must be adjacent to and directly below the instrument in the top center position.

(c) Required powerplant instruments must be closely grouped on the instrument panel. In addition-

(1) The location of identical powerplant instruments for the engines must prevent confusion as to which engine each instrument relates; and

(2) Powerplant instruments vital to the safe operation of the airplane must be plainly visible to the appropriate crewmembers.

(d) Instrument panel vibration may not damage or impair the accuracy of any instrument.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1322 Warning, caution, and advisory lights.

If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Administrator, be-

(a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights; and

(d) Any other color, including white, for lights not described in paragraphs (a) through (c) of this section, provided the color differs sufficiently from the colors prescribed in paragraphs (a) through (c) of this section to avoid possible confusion.

(Amdt. 25–38, Eff. 2/1/77)

§25.1323 Airspeed indicating system.

For each airspeed indicating system, the following apply:

(a) Each airspeed indicating instrument must be approved and must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration

of the systems to perform these functions are not adversely affected when the airplane is exposed to lightning.

(b) For functions whose failure would contribute to or cause a condition that would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions, each electrical and electronic system that performs these functions must be designed and installed to ensure that these functions can be recovered in a timely manner after the airplane is exposed to lightning.

(c) Compliance with the lightning protection criteria prescribed in paragraphs (a) and (b) of this section must be shown for exposure to a severe lighting environment. The applicant must design for and verify that aircraft electrical/electronic systems are protected against the effects of lightning by:

(1) Determining the lightning strike zones for the airplane;

(2) Establishing the external lightning environment for the zones;

(3) Establishing the internal environment;

(4) Identifying all the electrical and electronic systems that are subject to the requirements of this section, and their locations on or within the airplane;

(5) Establishing the susceptibility of the systems to the internal and external lightning environment;

(6) Designing protection; and

(7) Verifying that the protection is adequate.]

[(Amdt. 25–80, Eff. 5/3 1/94)]

INSTRUMENTS: INSTALLATION

§25.1321 Arrangement and visibility.

(a) Each flight, navigation, and powerplant instrument for use by any pilot must be plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) The flight instruments required by § 25.1303 must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of the pilot's forward vision. In addition—

(1) The instrument that most effectively indicates attitude must be on the panel in the top center position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top center position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top center position; and

(4) The instrument that most effectively indicates direction of flight must be adjacent to and directly below the instrument in the top center position.

(c) Required powerplant instruments must be closely grouped on the instrument panel. In addition-

(1) The location of identical powerplant instruments for the engines must prevent confusion as to which engine each instrument relates; and

(2) Powerplant instruments vital to the safe operation of the airplane must be plainly visible to the appropriate crewmembers.

(d) Instrument panel vibration may not damage or impair the accuracy of any instrument.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1322 Warning, caution, and advisory lights.

If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Administrator, be-

(a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights; and

(d) Any other color, including white, for lights not described in paragraphs (a) through (c) of this section, provided the color differs sufficiently from the colors prescribed in paragraphs (a) through (c) of this section to avoid possible confusion.

(Amdt. 25–38, Eff. 2/1/77)

§25.1323 Airspeed indicating system.

For each airspeed indicating system, the following apply:

(a) Each airspeed indicating instrument must be approved and must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration

of the systems to perform these functions are not adversely affected when the airplane is exposed to lightning.

(b) For functions whose failure would contribute to or cause a condition that would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions, each electrical and electronic system that performs these functions must be designed and installed to ensure that these functions can be recovered in a timely manner after the airplane is exposed to lightning.

(c) Compliance with the lightning protection criteria prescribed in paragraphs (a) and (b) of this section must be shown for exposure to a severe lighting environment. The applicant must design for and verify that aircraft electrical/electronic systems are protected against the effects of lightning by:

(1) Determining the lightning strike zones for the airplane;

(2) Establishing the external lightning environment for the zones;

(3) Establishing the internal environment;

(4) Identifying all the electrical and electronic systems that are subject to the requirements of this section, and their locations on or within the airplane;

(5) Establishing the susceptibility of the systems to the internal and external lightning environment;

(6) Designing protection; and

(7) Verifying that the protection is adequate.]

[(Amdt. 25–80, Eff. 5/3 1/94)]

INSTRUMENTS: INSTALLATION

§25.1321 Arrangement and visibility.

(a) Each flight, navigation, and powerplant instrument for use by any pilot must be plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) The flight instruments required by § 25.1303 must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of the pilot's forward vision. In addition—

(1) The instrument that most effectively indicates attitude must be on the panel in the top center position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top center position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top center position; and

(4) The instrument that most effectively indicates direction of flight must be adjacent to and directly below the instrument in the top center position.

(c) Required powerplant instruments must be closely grouped on the instrument panel. In addition-

(1) The location of identical powerplant instruments for the engines must prevent confusion as to which engine each instrument relates; and

(2) Powerplant instruments vital to the safe operation of the airplane must be plainly visible to the appropriate crewmembers.

(d) Instrument panel vibration may not damage or impair the accuracy of any instrument.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1322 Warning, caution, and advisory lights.

If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Administrator, be-

(a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights; and

(d) Any other color, including white, for lights not described in paragraphs (a) through (c) of this section, provided the color differs sufficiently from the colors prescribed in paragraphs (a) through (c) of this section to avoid possible confusion.

(Amdt. 25–38, Eff. 2/1/77)

§25.1323 Airspeed indicating system.

For each airspeed indicating system, the following apply:

(a) Each airspeed indicating instrument must be approved and must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration

occurs, that the presented data should not be relied upon.

(b) As used in this section, ''instrument'' includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier and an indicator connected together).

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1333 Instrument systems.

For systems that operate the instruments required by § 25.1303(b) which are located at each pilot's station-

(a) Means must be 'provided to connect the required instruments at the first pilot's station to operating systems which are independent of the operating systems at other flight crew stations, or other equipment;

(b) The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action, after any single failure or combination of failures that is not shown to be extremely improbable; and

(c) Additional instruments, systems, or equipment may not be connected to the operating systems for the required instruments, unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any malfunction of the additional instruments, systems, or equipment which is not shown to be extremely improbable.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch. position is not acceptable as a means of indication.

(Amdt. 25–41, Eff. 9/1/77)

§25.1337 Powerplant instruments.

(a) *Instruments and instrument lines.*

(1) Each powerplant and auxiliary power unit instrument line must meet the requirements of §§ 25.993 and 25.1183.

(2) Each line carrying flammable fluids under pressure must-

(i) Have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails; and

(ii) Be installed and located so that the escape of fluids would not create a hazard.

(3) Each powerplant and auxiliary power unit instrument that utilizes flammable fluids must be installed and located so that the escape of fluid would not create a hazard.

(b) *Fluid quantity indicator.* There must be means to indicate to the flight crewmembers, the quantity, in gallons or equivalent units, of usable fuel in each tank during flight. In addition-

(1) Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under § 25.959;

(2) Tanks with interconnected outlets and airspaces may be treated as one tank and need not have separate indicators; and

(3) Each exposed sight gauge, used as a fuel quantity indicator, must be protected against damage.

(c) *Fuel flowmeter system.* If a fuel flowmeter system is installed, each metering component must have a means for bypassing the fuel supply if malfunction of that component severely restricts fuel flow.

(d) *Oil quantity indicator.* There must be a stick gauge or equivalent means to indicate the quantity of oil in each tank. If an oil transfer or reserve oil supply system is installed, there must be a means to indicate to the flight crew, in flight, the quantity of oil in each tank.

(e) *Turbopropeller blade position indicator.* Required turbopropeller blade position indicators must begin indicating before the blade moves more than eight degrees below the flight low pitch stop. The source of indication must directly sense the blade position.

(f) *Fuel pressure indicator.* There must be means to measure fuel pressure, in each system supplying reciprocating engines, at a point downstream of any fuel pump except fuel injection pumps. In addition-

(1) If necessary for the maintenance of proper fuel delivery pressure, there must be a connection

occurs, that the presented data should not be relied upon.

(b) As used in this section, ''instrument'' includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier and an indicator connected together).

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1333 Instrument systems.

For systems that operate the instruments required by § 25.1303(b) which are located at each pilot's station-

(a) Means must be 'provided to connect the required instruments at the first pilot's station to operating systems which are independent of the operating systems at other flight crew stations, or other equipment;

(b) The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action, after any single failure or combination of failures that is not shown to be extremely improbable; and

(c) Additional instruments, systems, or equipment may not be connected to the operating systems for the required instruments, unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any malfunction of the additional instruments, systems, or equipment which is not shown to be extremely improbable.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch. position is not acceptable as a means of indication.

(Amdt. 25–41, Eff. 9/1/77)

§25.1337 Powerplant instruments.

(a) *Instruments and instrument lines.*

(1) Each powerplant and auxiliary power unit instrument line must meet the requirements of §§ 25.993 and 25.1183.

(2) Each line carrying flammable fluids under pressure must-

(i) Have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails; and

(ii) Be installed and located so that the escape of fluids would not create a hazard.

(3) Each powerplant and auxiliary power unit instrument that utilizes flammable fluids must be installed and located so that the escape of fluid would not create a hazard.

(b) *Fluid quantity indicator.* There must be means to indicate to the flight crewmembers, the quantity, in gallons or equivalent units, of usable fuel in each tank during flight. In addition-

(1) Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under § 25.959;

(2) Tanks with interconnected outlets and airspaces may be treated as one tank and need not have separate indicators; and

(3) Each exposed sight gauge, used as a fuel quantity indicator, must be protected against damage.

(c) *Fuel flowmeter system.* If a fuel flowmeter system is installed, each metering component must have a means for bypassing the fuel supply if malfunction of that component severely restricts fuel flow.

(d) *Oil quantity indicator.* There must be a stick gauge or equivalent means to indicate the quantity of oil in each tank. If an oil transfer or reserve oil supply system is installed, there must be a means to indicate to the flight crew, in flight, the quantity of oil in each tank.

(e) *Turbopropeller blade position indicator.* Required turbopropeller blade position indicators must begin indicating before the blade moves more than eight degrees below the flight low pitch stop. The source of indication must directly sense the blade position.

(f) *Fuel pressure indicator.* There must be means to measure fuel pressure, in each system supplying reciprocating engines, at a point downstream of any fuel pump except fuel injection pumps. In addition-

(1) If necessary for the maintenance of proper fuel delivery pressure, there must be a connection

occurs, that the presented data should not be relied upon.

(b) As used in this section, ''instrument'' includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier and an indicator connected together).

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1333 Instrument systems.

For systems that operate the instruments required by § 25.1303(b) which are located at each pilot's station-

(a) Means must be 'provided to connect the required instruments at the first pilot's station to operating systems which are independent of the operating systems at other flight crew stations, or other equipment;

(b) The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action, after any single failure or combination of failures that is not shown to be extremely improbable; and

(c) Additional instruments, systems, or equipment may not be connected to the operating systems for the required instruments, unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any malfunction of the additional instruments, systems, or equipment which is not shown to be extremely improbable.

(Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77)

§25.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch. position is not acceptable as a means of indication.

(Amdt. 25–41, Eff. 9/1/77)

§25.1337 Powerplant instruments.

(a) *Instruments and instrument lines.*

(1) Each powerplant and auxiliary power unit instrument line must meet the requirements of §§ 25.993 and 25.1183.

(2) Each line carrying flammable fluids under pressure must-

(i) Have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails; and

(ii) Be installed and located so that the escape of fluids would not create a hazard.

(3) Each powerplant and auxiliary power unit instrument that utilizes flammable fluids must be installed and located so that the escape of fluid would not create a hazard.

(b) *Fluid quantity indicator.* There must be means to indicate to the flight crewmembers, the quantity, in gallons or equivalent units, of usable fuel in each tank during flight. In addition-

(1) Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under § 25.959;

(2) Tanks with interconnected outlets and airspaces may be treated as one tank and need not have separate indicators; and

(3) Each exposed sight gauge, used as a fuel quantity indicator, must be protected against damage.

(c) *Fuel flowmeter system.* If a fuel flowmeter system is installed, each metering component must have a means for bypassing the fuel supply if malfunction of that component severely restricts fuel flow.

(d) *Oil quantity indicator.* There must be a stick gauge or equivalent means to indicate the quantity of oil in each tank. If an oil transfer or reserve oil supply system is installed, there must be a means to indicate to the flight crew, in flight, the quantity of oil in each tank.

(e) *Turbopropeller blade position indicator.* Required turbopropeller blade position indicators must begin indicating before the blade moves more than eight degrees below the flight low pitch stop. The source of indication must directly sense the blade position.

(f) *Fuel pressure indicator.* There must be means to measure fuel pressure, in each system supplying reciprocating engines, at a point downstream of any fuel pump except fuel injection pumps. In addition-

(1) If necessary for the maintenance of proper fuel delivery pressure, there must be a connection

(1) Provide sufficient illumination to make each instrument, switch and other device necessary for safe operation easily readable unless sufficient illumination is available from another source; and

(2) Be installed so that-

(i) Their direct rays are shielded from the pilot's eyes; and

(ii) No objectionable reflections are visible to the pilot.

(b) Unless undimmed instrument lights are satisfactory under each expected flight condition, there must be a means to control the intensity of illumination.

(Amdt. 25–72, Eff. 8/20/90)

§ 25.1383 Landing lights.

(a) Each landing light must be approved, and must be installed so that-

(1) No objectionable glare is visible to the pilot;

(2) The pilot is not adversely affected by halation; and

(3) It provides enough light for night landing.

(b) Except when one switch is used for the lights of a multiple light installation at one location, there must be a separate switch for each light.

(c) There must be a means to indicate to the pilots when the landing lights are extended.

§25.1385 Position light system installation.

(a) *General.* Each part of each position light system must meet the applicable requirements of this section and each system as a whole must meet the requirements of §§ 25.1387 through 25.1397.

(b) *Forward position lights.* Forward position lights must consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the airplane so that, with the airplane in the normal flying position, the red light is on the left side and the green light is on the right side. Each light must be approved.

(c) *Rear position light.* The rear position light must be a white light mounted as far aft as practicable on the tail or on each wing tip, and must be approved.

(d) *Light covers and color jilters.* Each light cover or color filter must be at least flame resistant and may not change color or shape or lose any appreciable light transmission during normal use.

(Amdt. 25–38, Eff. 2/1/77)

§25.1387 Position light system dihedral angles.

(a) Except as provided in paragraph (e) of this section, each forward and rear position light must, as installed, show unbroken light within the dihedral angles described in this section.

(b) Dihedral angle *L* (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the left of the first, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle *R* (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the right of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle *A* (aft) is formed by two intersecting vertical planes making angles of 70 degrees to the right and to the left, respectively, to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(e) If the rear position light, when mounted as far aft as practicable in accordance with § 25.1385(c), cannot show unbroken light within dihedral angle A (as defined in paragraph (d) of this section), a solid angle or angles of obstructed visibility totaling not more than 0.04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30° with a vertical line passing through the rear position light.

(Amdt. 25–30, Eff. 1 1/5/71)

§25.1389 Position light distribution and intensities.

(a) *General* The intensities prescribed in this section must be provided by new equipment with light covers and color filters in place. Intensities must be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the airplane. The light distribution and intensity of each position light must meet the requirements of paragraph (b) of this section.

(b) *Forward and rear position lights.* The light distribution and intensities of forward and rear position lights must be expressed in terms of minimum intensities in the horizontal plane, and maximum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles *L, R,* and *A,* and must meet the following requirements:

(1) Provide sufficient illumination to make each instrument, switch and other device necessary for safe operation easily readable unless sufficient illumination is available from another source; and

(2) Be installed so that-

(i) Their direct rays are shielded from the pilot's eyes; and

(ii) No objectionable reflections are visible to the pilot.

(b) Unless undimmed instrument lights are satisfactory under each expected flight condition, there must be a means to control the intensity of illumination.

(Amdt. 25–72, Eff. 8/20/90)

§ 25.1383 Landing lights.

(a) Each landing light must be approved, and must be installed so that-

(1) No objectionable glare is visible to the pilot;

(2) The pilot is not adversely affected by halation; and

(3) It provides enough light for night landing.

(b) Except when one switch is used for the lights of a multiple light installation at one location, there must be a separate switch for each light.

(c) There must be a means to indicate to the pilots when the landing lights are extended.

§25.1385 Position light system installation.

(a) *General.* Each part of each position light system must meet the applicable requirements of this section and each system as a whole must meet the requirements of §§ 25.1387 through 25.1397.

(b) *Forward position lights.* Forward position lights must consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the airplane so that, with the airplane in the normal flying position, the red light is on the left side and the green light is on the right side. Each light must be approved.

(c) *Rear position light.* The rear position light must be a white light mounted as far aft as practicable on the tail or on each wing tip, and must be approved.

(d) *Light covers and color jilters.* Each light cover or color filter must be at least flame resistant and may not change color or shape or lose any appreciable light transmission during normal use.

(Amdt. 25–38, Eff. 2/1/77)

§25.1387 Position light system dihedral angles.

(a) Except as provided in paragraph (e) of this section, each forward and rear position light must, as installed, show unbroken light within the dihedral angles described in this section.

(b) Dihedral angle *L* (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the left of the first, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle *R* (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the right of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle *A* (aft) is formed by two intersecting vertical planes making angles of 70 degrees to the right and to the left, respectively, to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(e) If the rear position light, when mounted as far aft as practicable in accordance with § 25.1385(c), cannot show unbroken light within dihedral angle A (as defined in paragraph (d) of this section), a solid angle or angles of obstructed visibility totaling not more than 0.04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30° with a vertical line passing through the rear position light.

(Amdt. 25–30, Eff. 1 1/5/71)

§25.1389 Position light distribution and intensities.

(a) *General* The intensities prescribed in this section must be provided by new equipment with light covers and color filters in place. Intensities must be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the airplane. The light distribution and intensity of each position light must meet the requirements of paragraph (b) of this section.

(b) *Forward and rear position lights.* The light distribution and intensities of forward and rear position lights must be expressed in terms of minimum intensities in the horizontal plane, and maximum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles *L, R,* and *A,* and must meet the following requirements:

Where ''y_0'' is the ''y'' coordinate of the Planckian radiator for the value of ''x'' considered.

(Amdt. 25–2?, Eff. 8/11/71)

§ 25.1399 Riding light.

(a) Each riding (anchor) light required for a seaplane or amphibian must be installed so that it Gill-

(1) Show a white light for at least two nautical miles at night under clear atmospheric conditions; and

(2) Show the maximum unbroken light practicable when the airplane is moored or drifting on the water.

(b) Externally hung lights may be used.

§ 25.1401 Anticollision light system.

(a) *General.* The airplane must have an anticollision light system that-

(1) Consists of one or more approved anticollision lights located so that their light will not impair the crew's vision or detract from the conspicuity of the position lights; and

(2) Meets the requirements of paragraphs (b) through (f) of this section.

(b) *Field of coverage.* The system must consist of enough lights to illuminate the vital areas around the airplane considering the physical configuration and flight characteristics of the airplane. The field of coverage must extend in each direction within at least 75° above and 75° below the horizontal plane of the airplane, except that a solid angle or angles of obstructed visibility totaling not more than 0.03 steradians is allowable within a solid angle equal to 0.15 steradians centered about the longitudinal axis in the rearward direction.

(c) *Flashing characteristics.* The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100 cycles per minute. The effective flash frequency is the frequency at which the airplane's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100 but not 180, cycles per minute.

(d) *Color.* Each anticollision light must be either aviation red or aviation white and must meet the applicable requirements of § 25.1397.

(b) *Light intensity.* The minimum light intensities in all vertical planes, measured with the red filter (if used) and expressed in terms of "effective" intensities, must meet the requirements of paragraph (f) of this section. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)dt}{0.2 + (t_2 - t_1)} ;$$

where—

I_e = effective intensity (candles).

$I(t)$ = instantaneous intensity as a function of time.

$t_2 - t_1$ = flash time interval (seconds)

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

(f) *Minimum effective intensities for anticollision lights.* Each anticollision light effective intensity must equal or exceed the applicable values in the following table.

Angle above or below the horizontal plane	Effective intensity (candles)
0° to 5°	400
5° to 10°	240
10° to 20°	80
20° to 30°	40
30° to 75°	20

(Amdt. 25–27, Eff. 8/11/71); (Amdt. 25–41, Eff. 9/1/77)

§25.1403 Wing icing detection lights.

Unless operations at night in known or forecast icing conditions are prohibited by an operating limitation, a means must be provided for illuminating or otherwise determining the formation of ice on the parts of the wings that are critical from the standpoint of ice accumulation. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties.

(Amdt. 25–38, Eff. 2/1/77)

SAFETY EQUIPMENT

§ 25.1411 General.

(a) *[Accessibility.* Required safety equipment to be used by the crew in an emergency must be readily accessible.]

Where ''y_0'' is the ''y'' coordinate of the Planckian radiator for the value of ''x'' considered.

(Amdt. 25–2?, Eff. 8/11/71)

§ 25.1399 Riding light.

(a) Each riding (anchor) light required for a seaplane or amphibian must be installed so that it Gill-

(1) Show a white light for at least two nautical miles at night under clear atmospheric conditions; and

(2) Show the maximum unbroken light practicable when the airplane is moored or drifting on the water.

(b) Externally hung lights may be used.

§ 25.1401 Anticollision light system.

(a) *General.* The airplane must have an anticollision light system that-

(1) Consists of one or more approved anticollision lights located so that their light will not impair the crew's vision or detract from the conspicuity of the position lights; and

(2) Meets the requirements of paragraphs (b) through (f) of this section.

(b) *Field of coverage.* The system must consist of enough lights to illuminate the vital areas around the airplane considering the physical configuration and flight characteristics of the airplane. The field of coverage must extend in each direction within at least 75° above and 75° below the horizontal plane of the airplane, except that a solid angle or angles of obstructed visibility totaling not more than 0.03 steradians is allowable within a solid angle equal to 0.15 steradians centered about the longitudinal axis in the rearward direction.

(c) *Flashing characteristics.* The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100 cycles per minute. The effective flash frequency is the frequency at which the airplane's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100 but not 180, cycles per minute.

(d) *Color.* Each anticollision light must be either aviation red or aviation white and must meet the applicable requirements of § 25.1397.

(b) *Light intensity.* The minimum light intensities in all vertical planes, measured with the red filter (if used) and expressed in terms of "effective" intensities, must meet the requirements of paragraph (f) of this section. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)dt}{0.2 + (t_2 - t_1)} ;$$

where—

I_e = effective intensity (candles).

$I(t)$ = instantaneous intensity as a function of time.

$t_2 - t_1$ = flash time interval (seconds)

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

(f) *Minimum effective intensities for anticollision lights.* Each anticollision light effective intensity must equal or exceed the applicable values in the following table.

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(Amdt. 25–27, Eff. 8/11/71); (Amdt. 25–41, Eff. 9/1/77)

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Unless operations at night in known or forecast icing conditions are prohibited by an operating limitation, a means must be provided for illuminating or otherwise determining the formation of ice on the parts of the wings that are critical from the standpoint of ice accumulation. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties.

(Amdt. 25–38, Eff. 2/1/77)

SAFETY EQUIPMENT

§ 25.1411 General.

(a) *[Accessibility.* Required safety equipment to be used by the crew in an emergency must be readily accessible.]

Where ''y_0'' is the ''y'' coordinate of the Planckian radiator for the value of ''x'' considered.

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(b) Externally hung lights may be used.

§ 25.1401 Anticollision light system.

(a) *General.* The airplane must have an anticollision light system that-

(1) Consists of one or more approved anticollision lights located so that their light will not impair the crew's vision or detract from the conspicuity of the position lights; and

(2) Meets the requirements of paragraphs (b) through (f) of this section.

(b) *Field of coverage.* The system must consist of enough lights to illuminate the vital areas around the airplane considering the physical configuration and flight characteristics of the airplane. The field of coverage must extend in each direction within at least 75° above and 75° below the horizontal plane of the airplane, except that a solid angle or angles of obstructed visibility totaling not more than 0.03 steradians is allowable within a solid angle equal to 0.15 steradians centered about the longitudinal axis in the rearward direction.

(c) *Flashing characteristics.* The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100 cycles per minute. The effective flash frequency is the frequency at which the airplane's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100 but not 180, cycles per minute.

(d) *Color.* Each anticollision light must be either aviation red or aviation white and must meet the applicable requirements of § 25.1397.

(b) *Light intensity.* The minimum light intensities in all vertical planes, measured with the red filter (if used) and expressed in terms of "effective" intensities, must meet the requirements of paragraph (f) of this section. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)dt}{0.2 + (t_2 - t_1)} ;$$

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I_e = effective intensity (candles).

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Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

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Unless operations at night in known or forecast icing conditions are prohibited by an operating limitation, a means must be provided for illuminating or otherwise determining the formation of ice on the parts of the wings that are critical from the standpoint of ice accumulation. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties.

(Amdt. 25–38, Eff. 2/1/77)

SAFETY EQUIPMENT

§ 25.1411 General.

(a) *[Accessibility.* Required safety equipment to be used by the crew in an emergency must be readily accessible.]

(2) Each element of the hydraulic system must be 'able to withstand, without rupture, the design operating pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously. Design operating pressure is maximum normal operating pressure, excluding transient pressure.

(b) *Tests and Analysis.*

(1) A complete hydraulic system must be static tested to show that it can withstand 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

(2) Compliance with § 25.1309 for hydraulic systems must be shown by functional tests, endurance tests, and analyses. The entire system, or appropriate subsystems, must be tested in an airplane or in a mock-up installation to determine proper performance and proper relation to other aircraft systems. The functional tests must include simulation of hydraulic system failure conditions. Endurance tests must simulate the repeated complete flights that could be expected to occur in service. Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested. Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the hydraulic system to the extent necessary to evaluate the environmental effects. Compliance with § 25.1309 must take into account the following:

(i) Static and dynamic loads including flight, ground, pilot, hydrostatic, inertial and thermally induced loads, and combinations thereof.

(ii) Motion, vibration, pressure transients, and fatigue.

(iii) Abrasion, corrosion, and erosion.

(iv) Fluid and material compatibility.

(v) Leakage and wear.

(c) *Fire protection.* Each hydraulic system using flammable hydraulic fluid must meet the applicable requirements of §§ 25.863, 25.1183, 25.1185, and 25.1189.

(Amdt. 25–13, Eff. 7/27/67); (Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77); (Amdt. 25–72, Eff. 8/20/90)

§25.1438 Pressurization and pneumatic systems.

(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

(Amdt. 25–41, Eff. 9/1/77)

§25.1439 Protective breathing equipment.

(a) If there is a class A, B, or E cargo compartment, protective breathing equipment must be installed for the use of appropriate crewmembers. In addition, protective breathing equipment must be installed in each isolated separate compartment in the airplane, including upper and lower lobe galleys, in which crewmember occupancy is permitted during flight for the maximum number of crewmembers expected to be in the area during any operation.

(b) For protective breathing equipment required by paragraph (a) of this section or by any operating rule of this chapter, the following apply:

(1) The equipment must be designed to protect the flight crew from smoke, carbon dioxide, and other harmful gases while on flight deck duty and while combating fires in cargo compartments.

(2) The equipment must include-

(i) Masks covering the eyes, nose, and mouth; or

(ii) Masks covering the nose and mouth, plus accessory equipment to cover the eyes.

(3) The equipment, while in use, must allow the flight crew to use the radio equipment and to communicate with each other, while at their assigned duty stations.

(4) The part of the equipment protecting the eyes may not cause any appreciable adverse effect on vision and must allow corrective glasses to be worn.

(5) The equipment must supply protective oxygen of 15 minutes duration per crewmember at a pressure altitude of 8,000 feet with a respiratory minute volume of 30 liters per minute BTPD. If a demand oxygen system is used, a

(2) Each element of the hydraulic system must be 'able to withstand, without rupture, the design operating pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously. Design operating pressure is maximum normal operating pressure, excluding transient pressure.

(b) *Tests and Analysis.*

(1) A complete hydraulic system must be static tested to show that it can withstand 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

(2) Compliance with § 25.1309 for hydraulic systems must be shown by functional tests, endurance tests, and analyses. The entire system, or appropriate subsystems, must be tested in an airplane or in a mock-up installation to determine proper performance and proper relation to other aircraft systems. The functional tests must include simulation of hydraulic system failure conditions. Endurance tests must simulate the repeated complete flights that could be expected to occur in service. Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested. Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the hydraulic system to the extent necessary to evaluate the environmental effects. Compliance with § 25.1309 must take into account the following:

(i) Static and dynamic loads including flight, ground, pilot, hydrostatic, inertial and thermally induced loads, and combinations thereof.

(ii) Motion, vibration, pressure transients, and fatigue.

(iii) Abrasion, corrosion, and erosion.

(iv) Fluid and material compatibility.

(v) Leakage and wear.

(c) *Fire protection.* Each hydraulic system using flammable hydraulic fluid must meet the applicable requirements of §§ 25.863, 25.1183, 25.1185, and 25.1189.

(Amdt. 25–13, Eff. 7/27/67); (Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77); (Amdt. 25–72, Eff. 8/20/90)

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(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

(Amdt. 25–41, Eff. 9/1/77)

§25.1439 Protective breathing equipment.

(a) If there is a class A, B, or E cargo compartment, protective breathing equipment must be installed for the use of appropriate crewmembers. In addition, protective breathing equipment must be installed in each isolated separate compartment in the airplane, including upper and lower lobe galleys, in which crewmember occupancy is permitted during flight for the maximum number of crewmembers expected to be in the area during any operation.

(b) For protective breathing equipment required by paragraph (a) of this section or by any operating rule of this chapter, the following apply:

(1) The equipment must be designed to protect the flight crew from smoke, carbon dioxide, and other harmful gases while on flight deck duty and while combating fires in cargo compartments.

(2) The equipment must include-

(i) Masks covering the eyes, nose, and mouth; or

(ii) Masks covering the nose and mouth, plus accessory equipment to cover the eyes.

(3) The equipment, while in use, must allow the flight crew to use the radio equipment and to communicate with each other, while at their assigned duty stations.

(4) The part of the equipment protecting the eyes may not cause any appreciable adverse effect on vision and must allow corrective glasses to be worn.

(5) The equipment must supply protective oxygen of 15 minutes duration per crewmember at a pressure altitude of 8,000 feet with a respiratory minute volume of 30 liters per minute BTPD. If a demand oxygen system is used, a

(2) Each element of the hydraulic system must be 'able to withstand, without rupture, the design operating pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously. Design operating pressure is maximum normal operating pressure, excluding transient pressure.

(b) *Tests and Analysis.*

(1) A complete hydraulic system must be static tested to show that it can withstand 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

(2) Compliance with § 25.1309 for hydraulic systems must be shown by functional tests, endurance tests, and analyses. The entire system, or appropriate subsystems, must be tested in an airplane or in a mock-up installation to determine proper performance and proper relation to other aircraft systems. The functional tests must include simulation of hydraulic system failure conditions. Endurance tests must simulate the repeated complete flights that could be expected to occur in service. Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested. Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the hydraulic system to the extent necessary to evaluate the environmental effects. Compliance with § 25.1309 must take into account the following:

(i) Static and dynamic loads including flight, ground, pilot, hydrostatic, inertial and thermally induced loads, and combinations thereof.

(ii) Motion, vibration, pressure transients, and fatigue.

(iii) Abrasion, corrosion, and erosion.

(iv) Fluid and material compatibility.

(v) Leakage and wear.

(c) *Fire protection.* Each hydraulic system using flammable hydraulic fluid must meet the applicable requirements of §§ 25.863, 25.1183, 25.1185, and 25.1189.

(Amdt. 25–13, Eff. 7/27/67); (Amdt. 25–23, Eff. 5/8/70); (Amdt. 25–41, Eff. 9/1/77); (Amdt. 25–72, Eff. 8/20/90)

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(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

(Amdt. 25–41, Eff. 9/1/77)

§25.1439 Protective breathing equipment.

(a) If there is a class A, B, or E cargo compartment, protective breathing equipment must be installed for the use of appropriate crewmembers. In addition, protective breathing equipment must be installed in each isolated separate compartment in the airplane, including upper and lower lobe galleys, in which crewmember occupancy is permitted during flight for the maximum number of crewmembers expected to be in the area during any operation.

(b) For protective breathing equipment required by paragraph (a) of this section or by any operating rule of this chapter, the following apply:

(1) The equipment must be designed to protect the flight crew from smoke, carbon dioxide, and other harmful gases while on flight deck duty and while combating fires in cargo compartments.

(2) The equipment must include-

(i) Masks covering the eyes, nose, and mouth; or

(ii) Masks covering the nose and mouth, plus accessory equipment to cover the eyes.

(3) The equipment, while in use, must allow the flight crew to use the radio equipment and to communicate with each other, while at their assigned duty stations.

(4) The part of the equipment protecting the eyes may not cause any appreciable adverse effect on vision and must allow corrective glasses to be worn.

(5) The equipment must supply protective oxygen of 15 minutes duration per crewmember at a pressure altitude of 8,000 feet with a respiratory minute volume of 30 liters per minute BTPD. If a demand oxygen system is used, a

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 100 degrees F.

(Amdt. 25–41, Eff. 9/1/77)

§25.1453 Protection of oxygen equipment from rupture.

Oxygen pressure tanks, and lines between tanks and the shutoff means, must be-

(a) Protected from unsafe temperatures; and

(b) Located where the probability and hazards of rupture in a crash landing are minimized.

§25.1455 Draining of fluids subject to freezing.

If fluids subject to freezing may be drained overboard in flight or during ground operation, the drains must be designed and located to prevent the formation of hazardous quantities of ice on the airplane as a result of the drainage.

(Amdt. 25–23, Eff. 5/8/70)

§25.1457 Cockpit voice recorders.

(a) Each cockpit voice recorder required by the operating rules of this chapter must be approved and must be installed so that it will record the following:

(1) Voice communications transmitted from or received in the airplane by radio.

(2) Voice communications of flight crewmembers on the flight deck.

(3) Voice communications of flight crewmembers on the flight deck, using the airplane's interphone system.

(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flight crewmembers using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(b) The recording requirements of paragraph (a)(2) of this section must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crewmembers on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in paragraph (a) of this section obtained from each of the following sources is recorded on a separate channel:

(1) For the first channel, from each boom, mask, or hand-held microphone, headset, or speaker used at the first pilot station.

(2) For the second channel from each boom, mask, or hand-held microphone, headset, or speaker used at the second pilot station.

(3) For the third channel-from the cockpit-mounted area microphone.

(4) For the fourth channel, from-

(i) Each boom, mask, or hand-held microphone, headset, or speaker used at the stations for the third and fourth crewmembers; or

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by. another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

(5) As far as is practicable all sounds received by the microphone listed in paragraphs (c)(l), (2), and (4) of this section must be recorded without interruption irrespective of the position of the interphone-transmitter key switch. The design shall ensure that sidetone for the flight crew is produced only when the interphone, public address system, or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that—

(1) It receives its electric power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads;

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact; and

(3) There is an aural or visual means for preflight checking of the recorder for proper operation.

(e) The record container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and con-

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 100 degrees F.

(Amdt. 25–41, Eff. 9/1/77)

§25.1453 Protection of oxygen equipment from rupture.

Oxygen pressure tanks, and lines between tanks and the shutoff means, must be-

(a) Protected from unsafe temperatures; and

(b) Located where the probability and hazards of rupture in a crash landing are minimized.

§25.1455 Draining of fluids subject to freezing.

If fluids subject to freezing may be drained overboard in flight or during ground operation, the drains must be designed and located to prevent the formation of hazardous quantities of ice on the airplane as a result of the drainage.

(Amdt. 25–23, Eff. 5/8/70)

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(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flight crewmembers using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(b) The recording requirements of paragraph (a)(2) of this section must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crewmembers on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in paragraph (a) of this section obtained from each of the following sources is recorded on a separate channel:

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(2) For the second channel from each boom, mask, or hand-held microphone, headset, or speaker used at the second pilot station.

(3) For the third channel-from the cockpit-mounted area microphone.

(4) For the fourth channel, from-

(i) Each boom, mask, or hand-held microphone, headset, or speaker used at the stations for the third and fourth crewmembers; or

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by. another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

(5) As far as is practicable all sounds received by the microphone listed in paragraphs (c)(l), (2), and (4) of this section must be recorded without interruption irrespective of the position of the interphone-transmitter key switch. The design shall ensure that sidetone for the flight crew is produced only when the interphone, public address system, or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that—

(1) It receives its electric power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads;

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact; and

(3) There is an aural or visual means for preflight checking of the recorder for proper operation.

(e) The record container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and con-

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 100 degrees F.

(Amdt. 25–41, Eff. 9/1/77)

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(Amdt. 25–23, Eff. 5/8/70)

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(5) Voice communications of flight crewmembers using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(b) The recording requirements of paragraph (a)(2) of this section must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crewmembers on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

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(i) Each boom, mask, or hand-held microphone, headset, or speaker used at the stations for the third and fourth crewmembers; or

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by. another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

(5) As far as is practicable all sounds received by the microphone listed in paragraphs (c)(l), (2), and (4) of this section must be recorded without interruption irrespective of the position of the interphone-transmitter key switch. The design shall ensure that sidetone for the flight crew is produced only when the interphone, public address system, or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that—

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(3) There is an aural or visual means for preflight checking of the recorder for proper operation.

(e) The record container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and con-

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(i) Each boom, mask, or hand-held microphone, headset, or speaker used at the stations for the third and fourth crewmembers; or

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by. another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

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